Incidental Parathyroidectomy During Thyroid Surgery Does Not Cause Transient Symptomatic Hypocalcemia

Aaron R. Sasson, MD; James F. Pingpank, Jr, MD; R. Wesley Wetherington, MD; Alexandra L. Hanlon, PhD; John A. Ridge, MD, PhD

Objectives: To identify any risk factors for incidental parathyroidectomy and to define its association with symptomatic postoperative hypocalcemia.

Design: Retrospective study.

Setting: Tertiary referral cancer center.

Patients: Consecutive patients who underwent thyroid surgery between 1991 and 1999. Patients who underwent procedures for locally advanced thyroid cancer requiring laryngectomy, tracheal resection, or esophagectomy were excluded.

Interventions: All pathology reports were reviewed for the presence of any parathyroid tissue in the resected specimen. Slides were reviewed, and information regarding patient demographics, diagnosis, operative details, and postoperative complications was collected.

Main Outcome Measure: Identification of parathyroid tissue in resected specimens and postoperative symptomatic hypocalcemia.

Results: A total of 141 thyroid procedures were performed: 69 total thyroidectomies (49%) and 72 total thyroid lobectomies (51%). The findings were benign in 68 cases (48%) and malignant in 73 cases (52%). In the entire series, incidental parathyroidectomy was found in 21 cases (15%). Parathyroid tissue was found in intrathyroidal (50%), extracapsular (31%), and central node compartment (19%) sites. The performance of a concomitant modified radical neck dissection was associated with an increased risk of unplanned parathyroidectomy ($P = .05$). There was no association of incidental parathyroidectomy with postoperative hypocalcemia ($P = .99$).

Multivariate analysis identified total thyroidectomy as a risk factor for postoperative hypocalcemia ($P = .008$). In the entire study group, transient symptomatic hypocalcemia occurred in 9 patients (6%), and permanent hypocalcemia occurred in 1 patient who underwent a total thyroidectomy and concomitant neck dissection.

Conclusions: Unintended parathyroidectomy, although not uncommon, is not associated with symptomatic postoperative hypocalcemia. Modified radical neck dissection may increase the risk of incidental parathyroidectomy. Most of the glands removed were intrathyroidal, so changes in surgical technique are unlikely to markedly reduce this risk.


HYPOIDECTOMY is typically associated with low morbidity if it is performed with the identification and preservation of the parathyroid glands and laryngeal nerves. Permanent or temporary dysfunction may result from conscious sacrifice or unintentional injury to these structures. Awareness of the anatomical relationships of the parathyroid glands is important in preventing hypocalcemia. The reported incidence of postthyroidectomy hypoparathyroidism ranges from less than 1% to 15%. Despite even careful surgical technique, temporary parathyroid dysfunction may result. Although several factors may be responsible for transient hypocalcemia, technical considerations include devascularization, trauma, and unintentional excision of 1 or more parathyroid glands. A recent study reported an incidental parathyroidectomy rate of 11%, with the majority of parathyroid tissue found in extracapsular locations. Reducing the unintentional resection of parathyroid glands might reduce the incidence of permanent and temporary hypocalcemia. Our goal was to investigate whether there is an association between incidental parathyroidectomy during thyroid surgery and postoperative hypocalcemia.

RESULTS

A total of 141 thyroid operations were performed between 1991 and 1999. Total thyroidectomy was performed in 69 cases (49%) and thyroid lobectomy in 72 cases (51%). The findings were benign in 68
PATIENTS AND METHODS

We retrospectively reviewed all standard thyroid operations (total thyroidectomies, subtotal thyroidectomies, and lobectomies) performed by a single attending surgeon (J.A.R.) at the Fox Chase Cancer Center, Philadelphia, Pa, between 1991 and 1999. Operations that included a simultaneous modified radical neck or central compartment node dissection were included in the analysis. Extensive thyroid procedures undertaken for locally advanced thyroid cancer, eg, requiring laryngectomy, tracheal resection, esophagectomy, or median sternotomy, were not included in the study group. Procedures for hyperparathyroidism were excluded from the study. Parathyroid tissue intimately involved with tumor was not considered to have been unintentionally resected.

Pathology reports on all specimens were reviewed for the presence of parathyroid tissue. Incidental parathyroidectomy was defined as parathyroid tissue identified in the resected specimen and distant from the tumor. Parathyroid tissue submitted separately for histological evaluation was not considered. For all specimens in which incidental parathyroid tissue was found, the slides were reviewed to identify their location (intrathyroidal, extracapsular, or in the central node compartment). The number, size, and histologic features of all foci of parathyroid tissue were also recorded.

Patient records were reviewed, and data concerning age, sex, and preoperative diagnosis were obtained. Operative reports were examined, and information regarding surgical procedure (total thyroidectomy or lobectomy), neck dissection, parathyroid autotransplantation, and number of parathyroid glands identified was collected. Any procedure in which a thyroid lobe was removed, including completion thyroidectomy, was considered a lobectomy. Any procedure, and postoperative complications are shown in Table 1.

Histopathological analysis identified 21 cases (15%) with incidental parathyroid tissue. Of these 21 cases, 10 (48%) were benign and 11 (52%) were malignant. Total thyroidectomy had been performed in 5 cases (24%). Also, in 2 cases (10%), parathyroid autotransplantation had been performed. The results of univariate analysis of patient variables and incidental parathyroidectomy are shown in Table 2.

Microscopic examination identified a total of 26 foci of parathyroid tissue in these 21 cases. The majority of cases demonstrated a single site of parathyroid tissue; however, there were 4 specimens in which multiple foci of parathyroid tissue were identified. Careful review was carried out to ensure that these specimens represented distinct parathyroid glands. Three parathyroidectomy specimens were unavailable for size measurements. In the remaining specimens (88%), the size of the parathyroid tissue was determined by measuring its greatest dimension (mean ± SEM, 3.9 ± 0.4 mm). The median size was 3.5 mm (range, 1.5-12.0 mm). Further histopathological inspection revealed that the majority of the parathyroid tissue were histologically normal; however, 3 foci were hypercellular, 1 was hypocellular, and 1 was adenomatous.

The parathyroid tissue in the resected specimen was found to be intrathyroidal in 50% of the cases. Intrathyroidal location was defined as parathyroid tissue completely contained within the thyroid capsule or completely surrounded by thyroid tissue. Parathyroid tissue was found adjacent to the thyroid capsule in 8 (31%) of the 26 foci found, and 5 (19%) of the glands were identified in the central compartment specimen. The central compartment was defined as the area between the internal jugular veins laterally, the sternal notch inferiorly, and the hyoid bone superiorly. Detailed information regarding location of the parathyroid glands was available from the operative reports of all patients, except 1. There was no association between intraoperative identification of parathyroid glands and the risk of incidental parathyroidectomy. No difference in the rate of unintended parathyroidectomy was found when fewer than 2 parathyroid glands were identified and when 2 or more were

Table 1

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Total thyroidectomy</td>
<td>26</td>
<td>15%</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>10</td>
<td>48%</td>
</tr>
<tr>
<td>Subtotal thyroidectomy</td>
<td>11</td>
<td>52%</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Location</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrathyroidal</td>
<td>13</td>
<td>50%</td>
</tr>
<tr>
<td>Extracapsular</td>
<td>4</td>
<td>15%</td>
</tr>
<tr>
<td>Central compartment</td>
<td>9</td>
<td>35%</td>
</tr>
</tbody>
</table>

Data were gathered on symptomatic hypocalcemia, calcium replacement, and recurrent laryngeal nerve function. Recurrent laryngeal nerve function was determined by laryngoscopy in all patients before and after their procedure.

Comparisons were made for unintentional parathyroidectomy and postoperative hypocalcemia. Predictors of both outcome measures were assessed by univariate and multivariate analyses. Univariate analysis of continuous variables was performed using a t test, and categorical values were determined using the Fisher exact test. Stepwise multivariate analysis was performed using logistic regression. All reported P values were 2-tailed, and exact probabilities are provided. Significance was determined for P ≤ .05.

Fine-needle aspiration was performed on all dominant thyroid lesions. A diagnosis of malignancy usually prompted a total thyroidectomy. Indeterminate cytological findings were followed up with a lobectomy and isthmectomy, unless intraoperative findings warranted a complete thyroid extirpation. Completion thyroidectomy was performed when malignancy was documented in the lobectomy specimen. Thyroidectomy was performed with extracapsular removal of the thyroid lobes, including the pyramidal lobe if present. Also, central compartment node clearance was regularly performed for carcinomas, and modified radical neck dissection was performed if lateral cervical lymphadenopathy was detected. Care was taken to preserve the recurrent laryngeal nerves and all parathyroid glands along with their blood supply as they were encountered during resection. The location and number of parathyroid glands identified were recorded in the operative record. After resection, the thyroid gland surface was carefully examined for the presence of parathyroid tissue. Parathyroid glands were autotransplanted using a standard technique. Parathyroid autotransplantation was also applied to any parathyroid gland whose viability or vascular supply appeared questionable.

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identified during a lobectomy ($P = .68$), and there was no difference noted when 2 or fewer parathyroid glands were identified and when 3 or more glands were identified during total thyroidectomy ($P = .45$). Hence, the ability to identify parathyroid glands during surgery did not have an impact on the rate of unintentional parathyroidectomy. Of the patients with incidental parathyroidectomy, only 1 developed transient hypocalcemia. This patient had 2 foci of intrathyroidal parathyroid tissue removed.

Univariate analysis identified concomitant modified radical neck dissection as a risk factor for unintentional parathyroidectomy ($P = .05$). A total of 15 concomitant neck dissections were performed, and 5 (33%) of these were associated with an incidental parathyroidectomy. A total of 6 foci of parathyroid tissue were found (1 patient had 2). Three of the 6 foci were intrathyroidal and 3 were in the central compartment.

In the entire series, postoperative hypocalcemia occurred in 10 patients (7%). Of these 10 patients, 9 had transient hypocalcemia (demonstrated by resolution of their symptoms when calcium supplementation was discontinued). The median time to recovery was 8 weeks or less (range, 4-44 weeks). One patient (0.7%) from this series has permanent hypoparathyroidism with circumoral numbness, requiring limited calcium supplementation without vitamin D 6 years after a total thyroidectomy, modified radical neck dissection, and parathyroid autotransplantation for metastatic papillary carcinoma.

Of the 21 surgical cases with an incidental parathyroidectomy, only 1 patient (5%) developed transient hypocalcemia. In this study group, there was no correlation between symptomatic hypocalcemia and incidental parathyroidectomy ($P = .99$).

Postoperative hypocalcemia (transient and permanent) developed in 9 (13%) of 69 patients with total thyroidectomies, compared with 1 (1%) of 72 patients with thyroid lobectomies ($P = .008$). The patient who developed temporary hypocalcemia after her lobectomy did so after a completion thyroidectomy and modified radical neck dissection for metastatic medullary carcinoma. A preoperative diagnosis of malignancy was correlated with postoperative hypocalcemia ($P = .02$). Also, modified radical neck dissection ($P = .07$) and parathyroid autotransplantation ($P = .07$) may be associated with hypocalcemia.

Sixty-nine total thyroidectomies were performed. With respect to postoperative hypocalcemia, no difference was seen when 2 or fewer parathyroid glands were identified and when 3 or more were identified ($P = .99$). Hence, intraoperative identification of parathyroid glands was not predictive of postoperative symptomatic hypocalcemia. Also, no other factor in this cohort was found to be associated with hypocalcemia and total thyroidectomy. Autotransplantation of parathyroid tissue was more
frequently performed in the hypocalcemic group than in the normocalcemic group (44% vs 18%) but did not reach statistical significance ($P = .10$).

Stepwise multivariate logistic regression analysis showed that total thyroidectomy was strongly associated with postoperative hypocalcemia ($P = .008$; odds ratio, 10.5) and that there was an increased risk of incidental parathyroidectomy associated with modified radical neck dissection ($P = .04$; odds ratio, 3.4).

This retrospective study did not demonstrate any relationship between incidental parathyroidectomy and symptomatic postthyroidectomy hypocalcemia. The incidence of incidental parathyroidectomy in this series (15%) is comparable to that (8%-19%) reported in other series. The importance of parathyroid identification and preservation during thyroid surgery has been emphasized by surgeons. Even when the surgical technique is meticulous, unintentional parathyroidectomy may ensue. The variable location of the parathyroid glands (and particularly the intracapsular site of some) contributes to the risk of incidental parathyroidectomy. In our series, half of the parathyroid glands removed unintentionally were within the thyroid capsule. A recent study reported a similar rate of 42%. It is doubtful that improvement in surgical technique could completely eliminate the risk of incidental parathyroidectomy. We failed to find any association between intraoperative identification of parathyroid glands and incidental removal of the glands. Dissection in search of all parathyroid glands seems unwarranted.

The average size of a normal parathyroid gland is approximately 6 mm. In our series, the average size of excised parathyroid tissue was 3.9 mm. Some discrepancy in size may be explained by the histopathological sampling and processing of the specimen. Serial sectioning of the specimen may capture only a portion of the actual parathyroid gland. This might explain the small fragments of parathyroid tissue found in some specimens. It has been postulated by Lee et al. that the thyroid disease may influence the ability to find parathyroid tissue in a thyroid specimen. The number of sections obtained and the pathologist’s diligence in examining the specimen may increase the likelihood of identification of parathyroid tissue. There was no difference in the rate of unintentional parathyroidectomy between procedures conducted with a preoperative diagnosis of malignant or benign thyroid disease. Information regarding preparation and sectioning of individual specimens is not available.

In this study, univariate and multivariate analyses identified modified radical neck dissection as a risk factor for unintentional parathyroidectomy. Of the 120 patients without an incidental parathyroidectomy, 10 (8%) simultaneously underwent a modified neck dissection. In contrast, 5 (24%) of 21 patients in whom parathyroid tissue was found underwent a neck dissection. In this subgroup, a total of 6 sites of parathyroid tissue were identified (1 patient had 2 intrathyroidal foci): 3 were located in the thyroid gland and 3 were in the central neck compartment. Advanced disease with cervical adenopathy is often accompanied by gross central compartment nodal disease as well. Hence, it is not surprising that with more extensive procedures, unintentional parathyroidectomy occurs more frequently. Only 1 of the 5 patients developed transient hypocalcemia. Increased awareness when dissecting the central compartment may reduce the risk of unintentional parathyroidectomy, but oncological principles should not be compromised. Inspection of the resected neck dissection specimen for parathyroid tissue, anticipating possible autotransplantation, seems prudent.

Transient hypocalcemia is common after thyroid surgery. Biochemical hypocalcemia has been reported in as many as 83% of cases, but symptomatic hypocalcemia is seen much less frequently. Injury, devascularization, and unintentional excision of parathyroid tissue have all been cited as causes of postoperative hypocalcemia. Although many other factors have been studied, the cause of postoperative hypocalcemia is probably multifactorial. The risk of severe postoperative hypocalcemia after total thyroidectomy is often cited as a reason not to use this procedure to treat small thyroid neoplasms. Two recent series reported incidences of 0.3% to 5.0% for temporary hypoparathyroidism and 0 to 0.5% for permanent hypoparathyroidism. In this study, univariate analysis identified a preoperative diagnosis of malignant disease ($P = .02$) and total thyroidectomy ($P = .008$) as being significantly associated with transient symptomatic postoperative hypocalcemia. Additional factors such as modified radical neck dissection and parathyroid autotransplantation, although not statistically significant, may also be associated with hypocalcemia ($P = .07$ for both). Simultaneous neck dissection is undertaken to treat advanced thyroid malignancy. It is not surprising that surgery for advanced disease may be associated with transient postoperative hypocalcemia. Permanent hypocalcemia in this study was similar to that previously reported. The 1 patient who developed permanent hypocalcemia underwent a total thyroidectomy, modified radical neck dissection, and parathyroid autotransplantation for an advanced papillary carcinoma.

Multivariate analysis identified total thyroidectomy as the sole predictor of postoperative hypocalcemia ($P = .008$). Analyzing the cohort of cases in which only total thyroidectomy was performed failed to reveal any contributing factors. In contrast to other authors, we did not find an association between identifying fewer than 3 parathyroid glands and hypocalcemia ($P = .99$).

We reserve parathyroid autotransplantation for glands found on the thyroid capsule after resection or for glands that are clinically devascularized during the operation. A recent study of routine parathyroid autotransplantation during thyroid surgery reported a 1% incidence of permanent hypoparathyroidism. The authors advocate complete parathyroidectomy and parathyroid reimplantation for patients with familial thyroid cancer, many of whom have parathyroid hyperplasia. For patients with nonfamilial disease, they attempt to preserve at least 1 parathyroid gland in situ.
and routinely autotransplant 1 or 2 parathyroid glands. Hence, the impact of the in situ glands, compared with the transplanted ones, on calcium homeostasis could not be determined.

Incidental parathyroidectomy is not uncommon, occurring in approximately 15% of cases in this series. Half of the glands were found within the thyroid gland, so some unintentional parathyroidectomies are probably unavoidable. Total thyroidectomy and a diagnosis of malignancy do not increase the incidence of unintentional parathyroidectomy, but simultaneous modified radical neck dissection may be a factor. No association between incidental parathyroidectomy and symptomatic hypocalcemia was found. Hence, unintentional parathyroidectomy does not appear to contribute to postoperative hypocalcemia.

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REFERENCES